

Name _____

Date _____

291 Compound Interest (Chapter 10)

When interest is compounded continuously, we use the formula:

$$A = Pe^{rt}$$

Where P is the principal, r is the interest rate, and t is time in years.

When interest is compounded n times a year, we use the formula:

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$

Where P is the principal, r is the interest rate, n is the number of times compounded in a year, and t is the number of years the investment will grow into the amount A.

1. How long will it take a \$1000 investment to earn \$90 if it is invested at an annual rate of 1.72% compounded quarterly?

$$1090 = 1000 \left(1 + \frac{0.0172}{4}\right)^{4t}$$

$$1.09 = (1.0043)^{4t}$$

$$\log 1.09 = 4t \log 1.0043$$

$$t \approx 5.02 \text{ yrs}$$

2. How much money must be invested at 2.25% compounded quarterly, to yield \$2,000 at the end of 5 years?

$$2000 = P \left(1 + \frac{0.0225}{4}\right)^{4 \cdot 5}$$

$$\boxed{\$ 1787.76 = P}$$

3. How long will it take \$250 to double if it is invested at 3.5% interest compounded annually?

$$500 = 250 \left(1 + \frac{0.035}{1}\right)^{1 \cdot t}$$

$$2 = 1.035^t$$

$$\log 2 = t \log 1.035$$

$$t = 20.1 \text{ yrs}$$

4. Redo #3 if the interest was compounded daily.

$$500 = 250 \left(1 + \frac{0.035}{365}\right)^{365t}$$

$$2 = (1.00009589)^{365t}$$

$$\log 2 = 365t \log (1.00009589)$$

$$\boxed{19.8 \text{ yrs} \approx t}$$

5. The Trusty Bank offers 6% interest compounded monthly and The Savings Bank offers 6.1% interest compounded quarterly. Which bank pays more interest per year?

$$A = P \left(1 + \frac{.06}{12}\right)^{12}$$

$$1.005^{12}$$

$$A = P(1.0617)$$

$$A = P \left(1 + \frac{.061}{4}\right)^4$$

$$1.01525$$

$$A = P \cdot 1.0624$$

SAVINGS BANK

6. \$10,000 is invested at 2.9% interest. Find the value of the investment after one year if the interest is compounded:

a. quarterly

b. daily

c. continuously

$$A = 10000 \left(1 + \frac{.029}{4}\right)^4$$

$$\$ 10293.17$$

$$10000 \left(1 + \frac{.029}{365}\right)^{365}$$

$$\$ 10294.23$$

$$A = 10000 e^{.029}$$

$$\$ 10294.25$$

7. How long will it take for \$400 to double at 1.5% compounded continuously?

$$800 = 400 e^{.015t}$$

$$\ln 2 = .015t$$

$$46.2 \text{ yrs} = t$$

8. How long will it take \$1000 to double at 4% compounded continuously?

$$2000 = 1000 e^{.04t}$$

$$\ln 2 = .04t$$

$$17.3 \text{ yrs} = t$$

9. What is the interest rate if \$500 grows to \$750 in 9 years compounded continuously?

$$750 = 500 e^{9r}$$

$$\ln 1.5 = 9r$$

$$.045 = r$$

$$4.5\%$$

10. What is the interest rate that will allow \$1000 to grow to \$1500 in 15 years if it compounded continuously?

$$1500 = 1000 e^{15r}$$

$$1.5 = e^{15r}$$

$$\ln 1.5 = 15r$$

$$.027 = r$$

$$2.7\%$$